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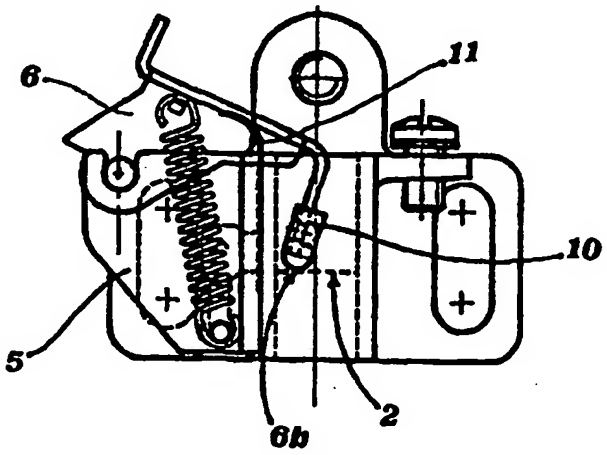

(57) Abstract

Brush-holder for electric motors provided with a wear signalling device, comprising a metal body for guiding the brush, pressure-spring means which act on the brush by means of an oscillating pressure finger, and electrically insulated contact means designed to be energized when the oscillating pressure finger reaches the end of its travel for activation of a signalling circuit. According to the invention, said pressure finger is mounted in an oscillating manner on an insulating support separate from said brush guide body and stably fixed on the latter. Moreover, said electrically insulated contact means comprise, on the one hand, a resilient metal strip, projecting from the said guide body, for direct contact with the oscillating pressure finger and, on the other hand, a conducting cross-member mounted on said insulating support and electrically connected to the said oscillating pressure finger by means of said spring means.

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BRUSH-HOLDER WITH WEAR DETECTION DEVICE

As is known, the supplying of electric power to most electric motors is performed by means of so-called "brushes", i.e. conducting bars, usually made of graphite, the free end of which is kept in contact with the surface of the commutator, which rotates integrally with the rotor of the motor itself. For this purpose, the brush is mounted freely sliding inside a fixed guide, called a "brush-holder", and is pressed against the commutator by respective pressure-spring means; these means are able to follow the sliding movement of the brush inside the brush-holder as the wear occurs, said wear occurring relatively rapidly precisely on account of the functional characteristics of the brush.

Precisely for this reason it is extremely important, particularly in the case of more powerful motors, to have means for detecting the wear of the brushes. In fact, when the brush is close to the end of its life, the contact with the surface of the commutator is no longer perfect and the risks of damage to the brush-holder and/or even the motor increase substantially.

It is therefore known of brush-holders provided with means for detecting and signalling the wear of the brushes. A known device of this type is described for example in EP-B1-0,268,010 which envisages pressure-spring means acting on the brush by means of an oscillating pressure finger. This pressure finger has integral with it a cam which, when the pressure finger reaches a position close to the end of its travel, is able to actuate a microswitch; the latter then activates a signalling and alarm system.

This device is relatively complex, undoubtedly costly and moreover subject to damage as a result of the heat to which the brush-holder is normally subject.

Similar considerations are also applicable to the brush-holders according to the documents EP-A1 0,430,152 and EP-B1-0,360,197, the latter envisaging even the use of a potentiometer, movable together

with the oscillating pressure finger.

In another known arrangement, the brush-holder has associated with it an insulated contact pin connected to one of the electric poles of a signalling circuit; when the pressure finger reaches its end-of-travel position, its body comes directly into contact with the pin, which is therefore in turn crossed by the electric current and supplies power to the electric signalling circuit, activating it. This arrangement, which is certainly simpler and less costly, nevertheless has various drawbacks:

- Firstly, the oscillating pressure finger and the pressure spring have the same electric potential as the brush-holder body; therefore, during normal operation, the flowing of current across the spring may easily occur. This produces - particularly in the case of the already mentioned high-power motors which are subject to severe working conditions - overheating of the spring, with an annealing effect and hence loss of its resilient function.

- Moreover, in order to be able to cooperate with the body of the oscillating pressure finger, the aforementioned insulated contact pin is located in close proximity to the brush-holder body; even if it is isolated from the latter, it very frequently happens that the graphite powder produced as a result of wear of the brush is deposited on the insulation and forms a bridge between the brush-holder body and said pin, thus causing continuous powering of the signalling circuit. In order to restore the latter to its functional state, the brush-holder must therefore be disassembled and carefully cleaned;

- Finally, the contact between oscillating pressure finger and contact pin is rigid; consequently, when the brush is close to the predetermined wear limit for signalling and hence the pressure finger is resting on said contact pin, the working pressure on the brush rapidly diminishes or even becomes non-existent such that said brush operates subjecting the surface of the commutator to a hammering action, with accentuated sparking and hence damaging effects on the respective contact surfaces.

The object of the present invention is therefore that of proposing a device for signalling the wear of brushes of the general type described above, which has a simple and economical design and ensures moreover safe operation without any of the drawbacks mentioned. This object is achieved by means of the characteristic features mentioned in Claim 1.

In reality the use of insulating plastic material in the construction of brush-holders has already been proposed in the document EP-B1-0,403,897; however, in this case, no signalling device is provided, nor is it possible to envisage easy application thereof.

Further characteristic features and advantages of the device according to the invention will emerge, however, more clearly from the detailed description which follows, of a preferred embodiment thereof, provided by way of example and illustrated in the accompanying drawings, in which:

Figs. 1a and 1b show a front view of the brush-holder according to the invention, with the oscillating pressure finger in the start-of-travel and end-of-travel positions, respectively;

Figs. 2 and 3 show, respectively, a side view and plan view of the same brush-holder.

As shown in the drawings, the brush-holder comprises a main body 1 provided with a bracket 1a for attaching an electric cable (not shown) for connection of the brush 2. The body 1 has a tubular cross-section in the form of a parallelogram so as to constitute a guide 1b for a brush 2 in the form of a bar with a rectangular cross-section (see also Fig. 3).

The main body 1 extends moreover into a lug 3 in the form of a plate, provided with eyelet holes 1c for receiving screws or bolts (not shown) for fixing onto the flat surface of the fixed part (not shown) of the motor; the plate 3 also has engaging in it a bolt 4 for fixing the main power supply cable (also not shown).

On the side of the body 1 opposite to the lug 1a there is fixed a double right-angled support 5 which, according to a fundamental

characteristic feature of the present invention, is made of electric insulating material. The support 5 has in fact, seen in plan view, a substantial U-shaped section, the base 5a of which is used for fixing to the side of the body 1 and the two arms 5b and 5c are used mainly for supporting the pressure finger 6.

The support 5 is made preferably of plastic material, for example thermoplastic material, if necessary reinforced with glass fibre and/or mineral fillers, or thermosetting material, also reinforced. Alternatively, the support 5 may also be made of metal, although completely lined with a layer of insulating material.

The pressure finger 6, made of metal, is mounted oscillating about a pin 7 which is mounted with its ends housed in saddle-shaped recesses formed in the upper edge of the arms 5b and 5c (see Figures 1a and 1b). A central eyelet 6a of the pressure finger 6 has fastened to it one of the ends of a tension spring 8, the other end of which is fastened to a cross-member 9, described in more detail below.

The end 6b of the pressure finger 6 is covered by an insulating cap 10, via which it rests on the upper surface of the brush 2; alternatively, the pressure finger may also be mainly lined with a layer of insulating plastic material. Obviously it is also possible for the pressure finger 6 to be made completely of metal when, as in the case of some known arrangements, the upper surface of the brush 2 has fixed to it an insulating support head (not shown, for example of the type known by the trade name FLEXTOP).

The pressure finger 6 is designed to oscillate between a start-of-travel position (shown in continuous lines in Figure 1a), where its free end 6b-10 is resting on the top of a new brush 2, and an end-of-travel position (shown in continuous lines in Figure 1b) where the end 6a-10 is resting on a brush which is almost totally worn.

The cross-member 9 ends in a terminal 9a (Fig. 2) for the electrical connection to the signalling circuit; the terminal 9a projects preferably from the end close to the plate-shaped lug 3. When several

brush-holder units are associated in a high-output power supply assembly (as shown schematically in dashed lines in Figures 2 and 3), a single long bar 9 is mounted on several parallel supports 5 and also has a single terminal 9a in the position shown. Alternatively, it is possible, however, to provide as many single cross-members 9, with their respective terminals 9a, as there are supports 5, this being the case when it is required to signal separately the wear of each brush.

The brush-holder according to the invention also incorporates a metal contact strip 11 which, according to another important characteristic feature of the invention, is of a resilient nature and has a top end which is substantially arched, as shown, for the purpose explained in more detail below. This strip 11 is fixed against the wall of the body 1, between the latter and the base 5a of the U-shaped support 5, and therefore has the same electric potential as the body 1.

During operation, the brush 2 is supplied principally with the current conveyed by a flexible conductor (not shown) fixed to the connecting bracket 1a and partially also via the metal walls of the guide 1b formed in the body 1. The oscillating pressure finger 6 is perfectly isolated from these conducting metal parts thanks, on the one hand, to the insulating cap 10 and, on the other hand, to the mounting of the pin 7 on the arms 5b, 5c of the insulating support 5. The spring 8 is equally well insulated, being fixed to the insulated pressure finger 6 and to the cross-member 9 which is in turn mounted on the insulating support 5.

As a result of this mounting system it is ensured that no current is able to pass through the spring 8 during normal operation.

When the brush 2 has reached the predetermined wear limit and hence the pressure finger 6 has reached its bottom end-of-travel point, the arm 6c of the pressure finger comes into contact with the strip 11 (see position in Figure 1b); in this way the current is able to pass from the strip 11, across the pressure finger 6 and spring 8, to the cross-member 9 and hence to the terminal 9a, passing from the latter towards the signalling circuit. This circuit - which is not illustrated since it is

known per se and in any case does not form part of the present invention - activates a visual and/or acoustic alarm signal, on the basis of which the user is able to intervene in order to replace the worn brush.

Here it is important to note that, when contact occurs between finger 6 and strip 11 and hence the signal is produced, oscillation of the finger 6 is not stopped (as in the known art), but said finger is able to continue to exert its pressure on the brush 2, causing simply flexing of the strip 11, which offers minimum resistance. Therefore the operator has all the time needed to intervene for replacement of the brush, without having to worry about the brush making intermittent contact with the commutator.

The advantages of the device according to the invention are obvious, in contrast with the drawbacks of the known art mentioned initially, since:

- the electrical insulation of the spring 8 prevents the flow of current through it and hence the risk of overheating and annealing of the spring itself, and therefore loss of its function;

- there is no risk of the accidental formation of conduction bridges as a result of the graphite powder, since the strip 11 is always in contact with the conducting body 1, while the contact cross-member 9 is far from this body 1 and protected inside the U-shaped support 5;

- owing to the elasticity of the arched top end of the contact strip 11, interruption in the movement of the oscillating finger is avoided, the latter continuing to exert its regular pressure on the brush, thereby avoiding any intermittent contact with the latter.

It is understood, however, that the invention is not limited to the particular configuration illustrated above, which constitutes only a non-limiting example of the range of application of the invention, but that numerous variants are possible - in particular as regards application of the inventive principle itself to any form or structure of brush-holder - all these variants being within the reach of a person skilled in the art, without thereby departing from the scope of the invention itself.

Claims

1. Brush-holder for electric motors provided with a wear signalling device, comprising a metal body for guiding the brush, pressure-spring means which act on the brush by means of an oscillating pressure finger, and electrically insulated contact means designed to be energized when the oscillating pressure finger reaches the end of its travel for activation of a signalling circuit, characterized in that said pressure finger is mounted in an oscillating manner on an insulating support separate from said brush guide body and stably fixed on the latter.

2. Brush-holder as claimed in Claim 1, wherein said contact means comprise, on the one hand, a resilient metal strip projecting from the said guide body, for direct contact with the oscillating pressure finger at the end of the travel of the latter and, on other hand, a conducting cross-member mounted on said insulating support and electrically connected to the said oscillating pressure finger.

3. Brush-holder as claimed in Claim 1, wherein said pressure means consist of a metal spring fastened, on the one hand, to the oscillating pressure finger and, on the other hand, to said cross-member, so as to form at the same time the electrical connection between pressure finger and cross-member.

4. Brush-holder as claimed in Claim 1, wherein said insulating support is in the form of a body with a double right-angle or U-shaped cross-section, the base of which forms a wall for fixing to the brush guide body and the arms of which form a support for the pivot pin of the oscillating pressure finger and for said cross-member.

5. Brush-holder as claimed in Claim 4, wherein the pivot pin of said oscillating pressure finger is mounted with its opposite ends in two saddle-shaped recesses formed in the upper edge of said arms of the insulating support.

6. Brush-holder as claimed in Claim 1, wherein said contact

strip is fixed against the wall of the metal guide body, between the latter and the base of the insulating support body.

7. Brush-holder as claimed in Claim 1 or 6, wherein the upper free end of said contact strip is arched, for an elastically yielding contact with said spring-loaded pressure finger.

8. Brush-holder as claimed in Claim 1, wherein said cross-member is fixed with its ends in seats formed in the bottom part of the arms of said insulating support and extends at one of its ends in the form of a lug forming a terminal for connection of a conductor of the signalling circuit.

9. Brush-holder as claimed in Claim 8, wherein a single cross-member passes in succession through a plurality of insulating supports, arranged in parallel.

10. Brush-holder as claimed in Claim 1, wherein said insulating support is made preferably of plastic material, such as thermoplastic material, or thermosetting material, if necessary reinforced with glass fibre and/or mineral fillers.

11. Brush-holder as claimed in Claim 1, wherein said insulating support is made of metal completely lined with a layer of insulating material.

12. Brush-holder as claimed in Claim 1, wherein said pressure finger is made of metal and has its pressure end covered by an insulating cap.

13. Brush-holder as claimed in Claim 1, wherein said pressure finger is at least partially lined with a layer of insulating plastic material.

AMENDED CLAIMS

[received by the International Bureau on 24 April 1997 (24.04.97); original claims 1 and 2 amended; remaining claims unchanged (1 page)]

1) Brush-holder for electric motors provided with a wear signalling device, comprising a metal body for supporting and guiding at least a brush, pressure-spring means which act on said brush by means of a respective oscillating pressure finger, and electrically insulated contact means designed to be energized when the oscillating pressure finger reach the end of its travel for activation of a signalling circuit,

characterized in that each pressure finger is mounted in an oscillating manner on a respective insulating support, separate from and independently fixed on said metal guide body, the insulating supports being separated each other.

2) Brush-holder as claimed in Claim 1, wherein said contact means comprise, on the one hand, a resilient metal strip projecting from and electrically connected to said metal guide body, for direct contact with the oscillating pressure finger at the end of the travel of the latter and, on other hand, a conducting cross-member mounted through each insulating support and elettrically connected to the oscillating pressure fingers.

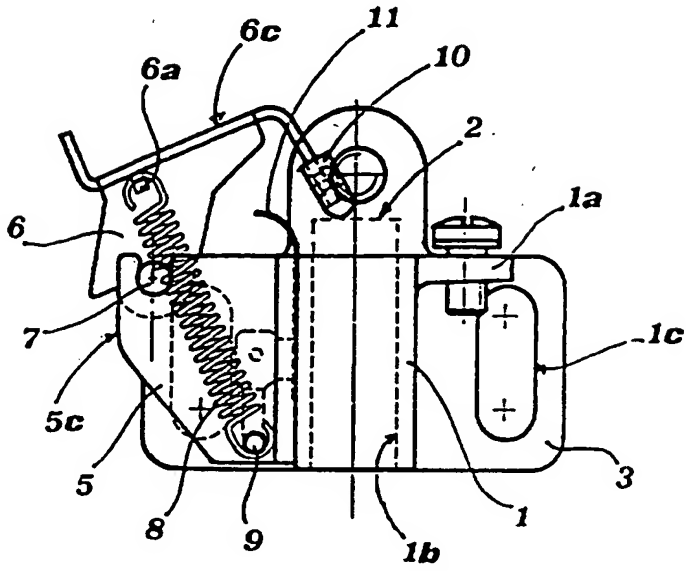


FIG.1a

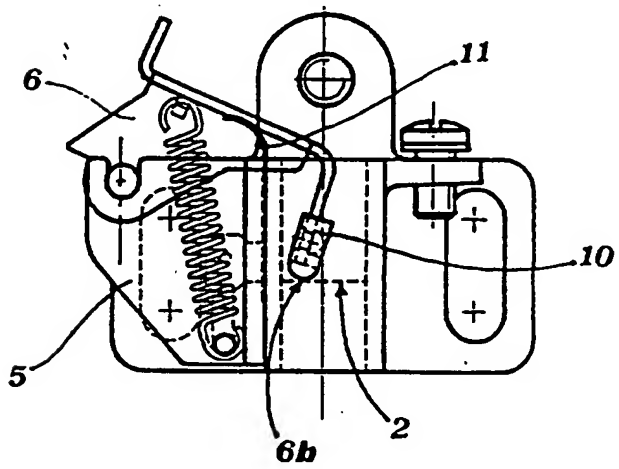
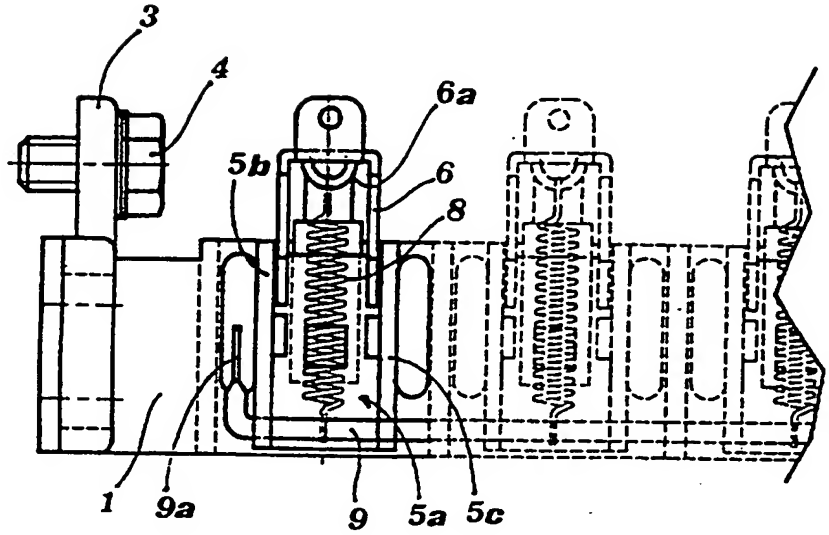


FIG.1b

FIG.2



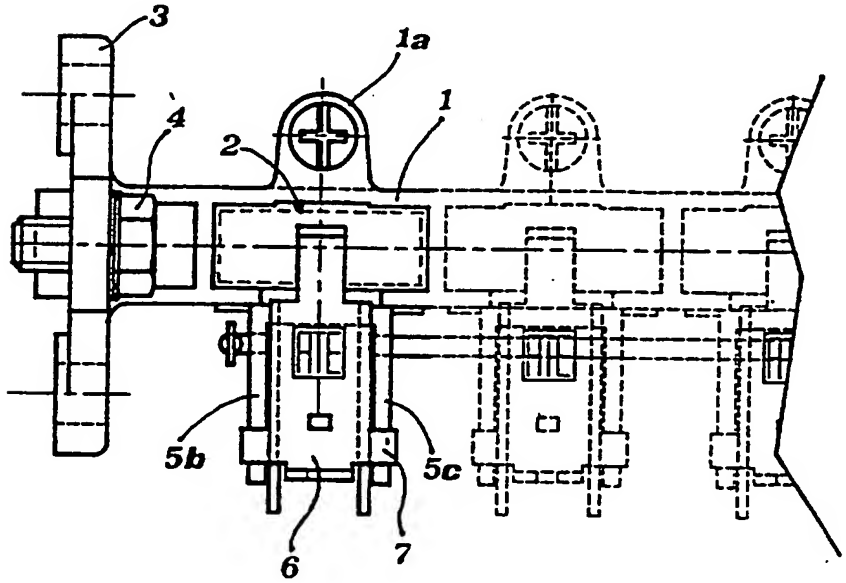


FIG.3

INTERNATIONAL SEARCH REPORT

Interr al Application No
PCT/EP 96/04483

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 H01R39/58

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 H01R

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	DE 82 14 872 U (HEID & CO., GMBH, KG, KOHLENBÜRSTEN- UND BÜRSTENHALTERFABRIK) 14 October 1982 see the whole document ---	1,2,4,5, 8,12 10
Y	EP 0 403 897 A (SCHUNK METALL & KUNSTSTOFF) 27 December 1990 cited in the application see page 3, column 4, line 38 - line 49; figure 2 ---	10
A	DE 84 16 981 U (EMW ELEKTRO-MOTOREN-FEINBAUWERK GROSSCHOPP & CO. GMBH) 12 December 1985 see page 4, line 10 - page 7, line 17; figures 1,2 --- -/--	1-13

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
20 January 1997	24. 01. 97

Name and mailing address of the ISA	Authorized officer
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INTERNATIONAL SEARCH REPORT

Intern nal Application No
PCT/EP 96/04483

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	DE 86 00 934 U (ANTON PILLER GMBH & CO. KG) 24 April 1986 see page 4, line 4 - line 28; figure 1 ---	1-13
A	DE 83 16 492 U (BOHNENBLUST & FIETRICH GMBH) 24 November 1983 see page 2, line 15 - page 3, line 19; figures 1-3 -----	1-5,12

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INTERNATIONAL SEARCH REPORT

...formation on patent family members

Inter nal Application No
PCT/EP 96/04483

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE-U-8214872	14-10-82	NONE	
EP-A-0403897	27-12-90	DE-A- 3920147	10-01-91
DE-U-8416981	12-12-85	NONE	
DE-U-8600934	24-04-86	NONE	
DE-U-8316492	24-11-83	NONE	

Index of Claims

Application No.	Applicant(s)	
10/812,297	DINGFELDER ET AL.	
Examiner	**Art Unit**	
John P Fitzgerald	2856	

√	Rejected	–	(Through numeral) Cancelled	N	Non-Elected	A	Appeal
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Claim		Date
Final	Original	12/10/04
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